

NEW WINTER STONEFLIES (PLECOPTERA: CAPNIIDAE) FROM THE COAST RANGE OF CALIFORNIA

C. RILEY NELSON¹ AND RICHARD W. BAUMANN²

¹Department of Zoology and Brackenridge Field Laboratory,
University of Texas, Austin, Texas 78712

²M. L. Bean Museum and Department of Zoology,
Brigham Young University, Provo, Utah 84602

Abstract.—Two species of phylogenetic importance are named from the Coast Range of California: *Capnia fialai* NEW SPECIES and *Mesocapnia bulbosa* NEW SPECIES. Descriptions, diagnoses, illustrations, and modifications of existing keys are presented. The phylogenetic relationships of these species in their respective genera are given.

Key Words.—Insecta, Plecoptera, Capniidae, *Capnia fialai*, *Mesocapnia bulbosa*, California, aquatic insects

After completion of our revision of *Capnia* (Nelson & Baumann 1989) we saw an unusual series of capniids collected by Gene and Lola Fiala. Additionally, we collected the species of *Mesocapnia* described herein. We were amazed to see a radically different species from western North America after viewing more than 20,000 specimens of *Capnia*. The *Mesocapnia* are also unique and readily discernible as new. Following are descriptions and comments on these; measurements and morphological interpretations follow Nelson & Baumann (1987, 1989).

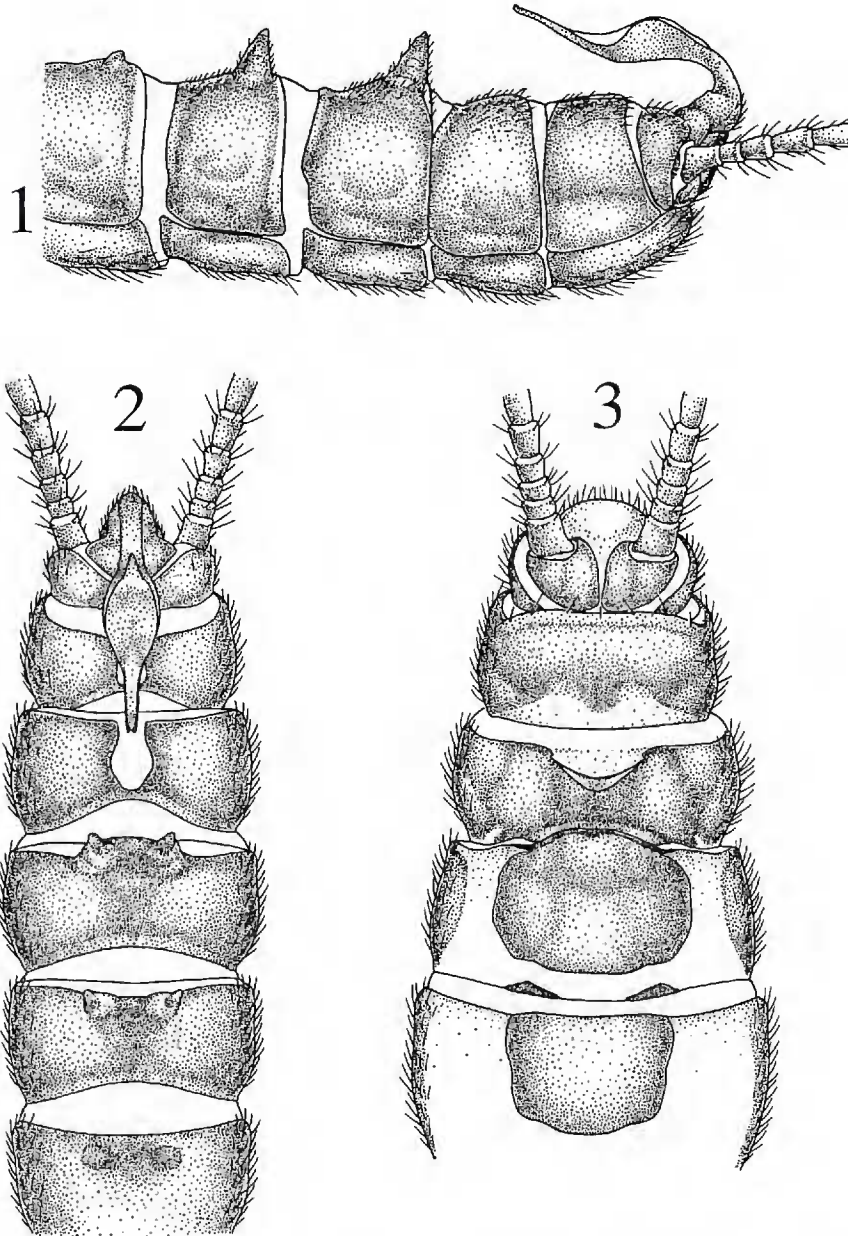
Abbreviations.—We use the following abbreviations for specimen deposition: (BYU), the Monte L. Bean Life Science Museum, Brigham Young University; (CAS), the California Academy of Sciences, San Francisco; (USNM), Smithsonian Institution, U.S. National Museum of Natural History, Washington, D.C.

CAPNIA FIALAI NELSON & BAUMANN, NEW SPECIES (Figs. 1–3, 8)

Types.—Male holotype and female allotype, Data: CALIFORNIA. *HUMBOLDT Co.*: stream 1 km E of Cedar Creek crossing hwy 299 (milemarker 31.5), 21 Mar 1988, G. R. Fiala. Holotype and allotype deposited at CAS; paratype, same data as holotype, 1 female, deposited at BYU.

Description.—Male.—Body length 6.0 mm; wings: apterous; body and appendages black, intersegmental membranes white; paired tergal knobs present on abdominal segments five through seven, increasing in size posteriorly, knobs on segments six and seven with acute apices, apices directed slightly posterior to a plane perpendicular to the long axis of the abdomen (lateral view, Fig. 1); terga eight and nine nearly divided by medial membranous areas (Fig. 2), division incomplete because of narrow bridge on anterior margin of both segments; epiproct recurved over abdomen, reaching to midlength of abdominal segment eight (Fig. 1); epiproct (lateral aspect): length 0.72 mm, greatest width 0.18 mm, narrow neck, greatest bulb depth approximately 3 × narrowest neck width with greatest depth expansion at area one-third distance from neck to apex; tip long (one-half epiproct length) and shallow (one-half neck depth) with dorsomedial membranous area apparent even in lateral view (Fig. 1); epiproct (Fig. 2) (dorsal aspect) with narrow neck expanded laterally to form bulb 3 × narrowest neck width at greatest extent, narrowing into tip which is slightly narrower than neck.

Female.—Body length 6.8 mm; wings: apterous; body and appendages black; subgenital plate with medial excavation on posterior margin one-third width of segment and one-third length of sternum



Figures 1–3. *Capnia fialai*. Figure 1. Lateral view male terminalia. Figure 2. Dorsal view male terminalia. Figure 3. Ventral view female terminalia.

eight, margin of excavation with in-folded lip of light colored sclerotization, internal sclerotization of vagina scarcely visible through subgenital plate (Fig. 3); sterna seven and eight joined medially for one-third width of segments (approximately width of excavated area of subgenital plate) but actual juncture not visible because heavily sclerotized posterior margin of sternum seven overlaps base of sternum eight.

Diagnosis. — Within *Capnia*, the males of this species may be diagnosed using the following key modified from the species group key in Nelson & Baumann (1989:292).

- 4(1). Male abdominal terga bearing three pairs of knobs, either on segments six to eight or on five to seven (Figs. 1, 2; Nelson & Baumann 1989: figs. 153, 154) 4a
- Male terga with fewer knobs (may be absent), never on all three listed segments (Nelson & Baumann 1989: figs. 14, 26, 66, 70) 5
- 4a(4). Paired tergal knobs on segments six to eight *sextuberculata* Jewett
- Paired tergal knobs on segments five to seven (Figs. 1, 2) *fialai* NEW SPECIES

Males of *C. fialai* superficially resemble some species in the *nana* group in having shortened wings, a laterally expanded epiproct, and an elongate epiproct

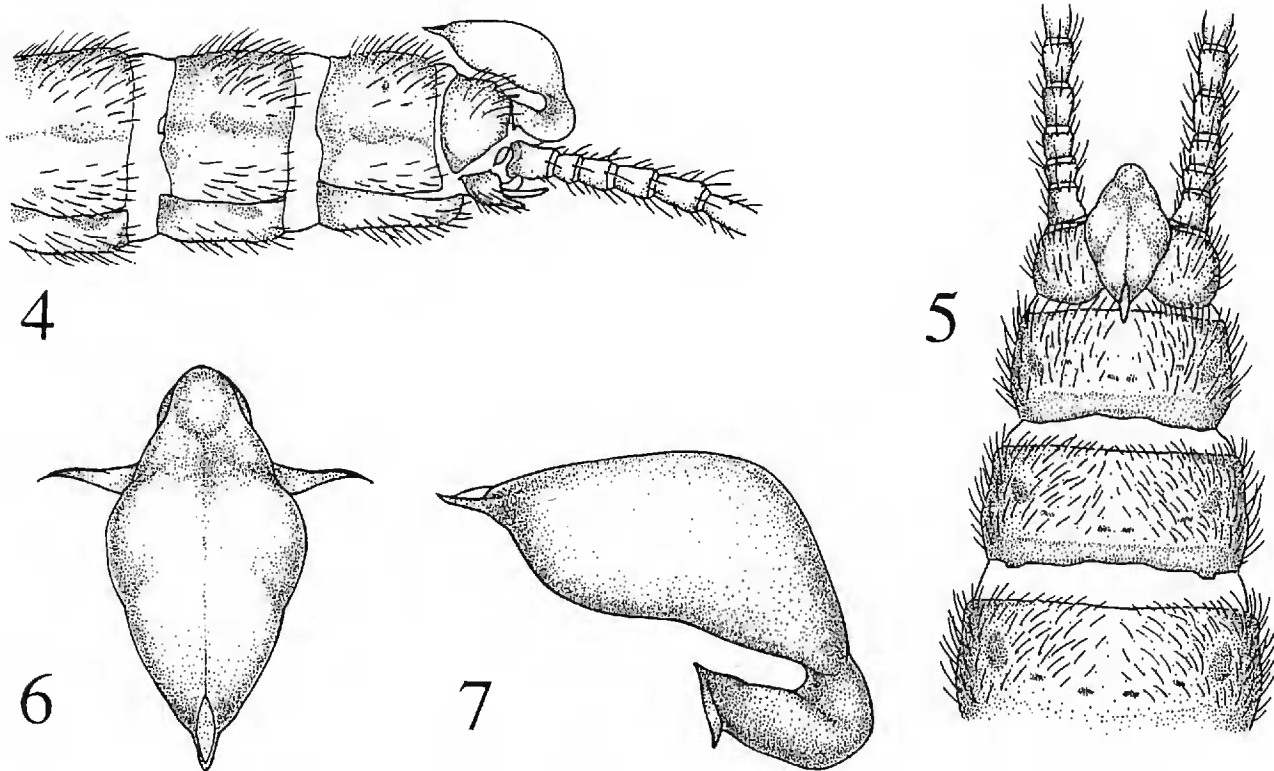
tip. No species of this group share this particular combination of characters. Additionally, no members of the *nana* group have three pairs of tergal knobs. Females of *C. fialai* share a medially excavated subgenital plate with *C. cheama* Ricker, *C. confusa* Claassen, and *C. teresa* Claassen. None of these species has the posterior margin of sternum seven joined to and overlapping sternum eight. Sternum seven of *C. confusa* is joined to sternum eight in a much narrower medial bridge than in *C. fialai* but this does not overlap the anterior margin of sternum eight. The female of *C. fialai* would run to the *vernalis* group in couplet 14 of Nelson & Baumann's key (1989). It differs from members of this group in having a broad overlapping junction of sternum seven and eight.

Etymology.—This species is named for Gene Fiala of Gresham, Oregon, who caught the only known specimens.

Taxonomic placement.—This species does not fit well into any of the presently defined species groups (Nelson & Baumann 1989). The basis for its inclusion in *Capnia* is the general shape of the epiproct and subgenital plate, showing similarities to *C. melia*, *C. nana*, and *C. sextuberculata*. It could be alternatively placed in *Paracapnia* because of some similarity in the shape of the epiproct and the extensive dorsomedial membranous area of the epiproct; the females of *Paracapnia*, however, have characteristic notches on the posterior margin of sternum eight that demarcate the lateral extent of the subgenital plate on that segment. These lateral notches are absent in both the allotype and paratype females of *C. fialai*. Based on this female character we include *C. fialai* in *Capnia*. If winged populations of this species were found, support for this placement could come from the base of R₁ vein curving forward; absence of such a curve would indicate a necessary transfer to *Paracapnia*. Additional support for placement in *Capnia* is the relative paucity of hairs, especially long ones on the abdomen. All *Paracapnia* examined have dense, long hairs covering most of the abdomen.

Ecology.—The stream where this species was collected has a very high gradient with many waterfalls. The stream substrate is large granite boulders intermingled with cobble and sharp-edged sand. Additional comments regarding streams of this area which might harbor this species are available in Baumann & Lauck (1987) and Wilkinson (1986). Other species found with this species which might indicate the water quality of this stream include: *Soliperla quadrispinula* (Jewett) (Peltoperlidae), *Kathroperla takhoma* Stark & Surdick (Chloroperlidae), *Salmo-perla sylvanica* Baumann & Lauck (Perlodidae), *Doroneuria baumanni* Stark & Gaufin (Perlidae), *Capnia excavata* Claassen (Capniidae), *Paraleuctra andersoni* Harper & Wildman (Leuctridae), *Malenka cornuta* (Claassen) (Nemouridae), and *Agathon comstocki* (Diptera: Blephariceridae) (stonefly records from Nelson & Stark 1988).

Phylogenetic characters.—This species shares characters thought to be apomorphic with both the *nana* and *vernalis* groups, as well as the unplaced species *C. sextuberculata*, which indicates its potential importance in the phylogeny of the genus. There is a fairly close relationship between the *nana* and *vernalis* groups (unpublished data); possible character transformations include the multiple tergal knobs: as plesiomorphic to the clade containing the *nana* and *vernalis* groups, as a synapomorphy uniting *C. fialai* and *C. sextuberculata*, or as homoplasy. We tentatively believe that this character is a synapomorphy for the entire group mentioned.



Figures 4–7. *Mesocapnia bulbosa*. Figure 4. Lateral view male terminalia. Figure 5. Dorsal view male terminalia. Figure 6. Dorsal view male epiproct. Figure 7. Lateral view male epiproct.

MESOCAPNIA BULBOSA NELSON & BAUMANN, NEW SPECIES
(Figs. 4–8)

Types. — Male holotype, Data: CALIFORNIA. *STANISLAUS Co.*: Del Puerto Creek, Frank Raines Regional Park, 20 Feb 1985, R. W. Baumann and C. R. Nelson; deposited in CAS. Paratypes: CALIFORNIA. *ALAMEDA Co.*: Arroyo Mocho, Mines Rd nr Santa Clara County line, 20 Feb 1985, R. W. Baumann and C. R. Nelson, 1 male deposited at BYU; Mines Rd, 34km (9 mi) SE of Livermore, 20 Feb 1985, R. W. Baumann and C. R. Nelson, 1 male deposited at BYU. *SANTA CLARA Co.*: 1.6 km (1 mi) E of jct Del Puerto Rd and Mines Rd, 18 Mar 1958, S. W. Hitchcock, 8 males deposited in BYU and USNM.

Description. — Male, body length 4.25 mm; wings: macropterous, very slightly brachypterous, forewing length 3.6 mm; body color brown, wings evenly brown infuscate, not particularly lighter or darker at cord or near veins; tergal knobs absent, all abdominal terga with both anterior and posterior margins entire; epiproct apex acute, with a short spine (Fig. 4); epiproct inflated both laterally and dorsoventrally, bulb seven-eighths length of epiproct in both dorsal and lateral views (Figs. 4–7); epiproct curved over abdomen, reaching only to midpoint of tergum nine.

Female. — Unknown.

Diagnosis. — Within *Mesocapnia*, *bulbosa* is unique in having the epiproct inflated in both lateral and dorsoventral planes. In dorsal view (Figs. 5, 6) it resembles *Mesocapnia arizonensis* (Baumann & Gaufin) (Baumann & Gaufin 1970: fig. 28) but that species has a dorsoventrally compressed epiproct (Baumann & Gaufin 1970: fig. 27). The extent of dorsoventral inflation of the epiproct in *M. bulbosa* is unique in the genus. Dorsoventral inflation of a much more limited extent is present in *M. oenone* (Neave) and *M. ogotoruka* (Jewett) but the linear facies of the epiproct is maintained in both of these species.

This species can be included in the key of Baumann & Gaufin (1970) with the following modifications:

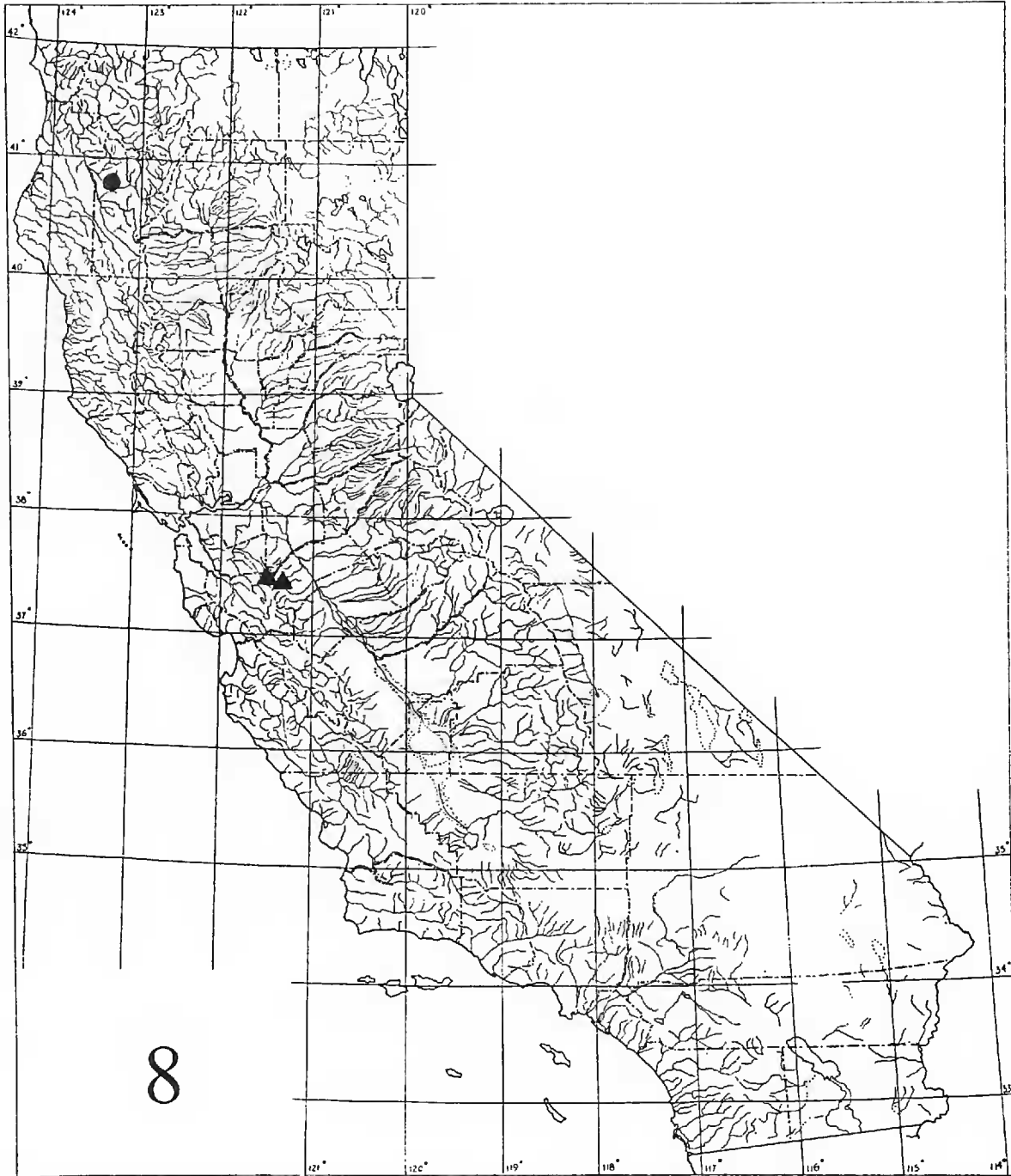


Figure 8. Distribution map. *Capnia fialai*, solid circle; *Mesocapnia bulbosa*, solid triangles.

- 2(1). Supra-anal process [epiproct, by current terminology] very broad dorsally (Fig. 6; Baumann & Gaufin 1970: fig. 28); wings slightly to considerably brachypterous 2a
- Supra-anal process [epiproct] narrow or only moderately broad dorsally 3
- 2a(2). Epiproct dorsoventrally compressed (Baumann & Gaufin 1970: fig. 28), wings distinctly shorter than abdomen *arizonensis*
- Epiproct dorsoventrally inflated (Fig. 6), wings at most slightly shorter than abdomen *bulbosa* NEW SPECIES

Etymology. — The specific epithet *bulbosa* is the feminine form of the latin bulbosus, in reference to the broad expanded and inflated epiproct of the male and is used as an adjective agreeing in feminine gender with *Mesocapnia*.

Taxonomic placement. — *Mesocapnia bulbosa* is unmistakably placed in *Mesocapnia*. It has the distinctive spine at the epiproctal tip (Figs. 6, 7) a synapomorphy uniting this clade. It also lacks tergal knobs as do all members of the clade.

Ecology. — The stream from which this species was taken is intermittent. Surface flow of Del Puerto Creek at Frank Raines Park was completely absent 29 May

1989 (CRN, unpublished data), a condition which occurred also during the summer of 1988 (Norman D. Penny, personal communication). Other stoneflies occurring at the sites where this species was collected include (as recorded in Nelson & Baumann, 1987 under *C. hitchcocki* Nelson & Baumann): *Bolshecapnia maculata* (Jewett), *C. hitchcocki*, *C. umpqua* Frison, *M. projecta* (Frison), and *Taenionema californicum* (Needham & Claassen).

Phylogenetic characters.—The laterally expanded epiproct as well as the small size of this species and of *M. arizonensis* are interpreted here as synapomorphies. The character state of unicolorous wings of both of these species is considered to be a relatively low weight synapomorphy. These sister species are joined with *M. oenone* and *M. ogotoruka* by a synapomorphy of a dorsoventrally inflated epiproct. The deflation of the epiproct in *M. arizonensis* is interpreted as apomorphic reduction, because of the rippled dorsal surface of the epiproct of this species when viewed in lateral aspect (Baumann & Gaufin 1970: fig. 27).

ACKNOWLEDGMENT

We thank Gene R. and Lola Fiala for their efforts in collecting winter stoneflies from throughout the Pacific Northwest. We also thank O. S. Flint, Jr., at the Smithsonian Institution, Washington, D.C., for providing some of the material upon which this study is based, Jean A. Stanger for the illustrations, and Paul H. Arnaud of the California Academy of Sciences, San Francisco, for information regarding collection localities in Arroyo Mocho and Del Puerto Canyon. We thank Tom and Marion Tilton and the administrators of the Tilton Fellowship at the California Academy of Sciences for support given the senior author. We also acknowledge the directors and staff of the Monte L. Bean Life Science Museum and Department of Zoology at Brigham Young University for financial assistance.

LITERATURE CITED

- Baumann, R. W. & A. R. Gaufin. 1970. The *Capnia projecta* complex of western North America (Plecoptera: Capniidae). *Trans. Amer. Entomol. Soc.*, 96: 435–468.
- Baumann, R. W. & D. R. Lauck. 1987. *Salmoperla*, a new stonefly genus from northern California (Plecoptera: Perlodidae). *Proc. Entomol. Soc. Washington*, 89: 825–830.
- Nelson, C. R. & R. W. Baumann. 1987. New winter stoneflies of the genus *Capnia* with notes and an annotated checklist of the Capniidae of California (Plecoptera: Capniidae). *Entomography*, 5: 485–521.
- Nelson, C. R. & R. W. Baumann. 1989. Systematics and distribution of the winter stonefly genus *Capnia* (Plecoptera: Capniidae) in North America. *Great Basin Natur.*, 49: 289–363.
- Nelson, C. R. & B. P. Stark. 1988. The *Salmoperla* safari: hit and run stonefly collecting in Nevada and California. *Perla*, 8 (1986–87): 7–11.
- Wilkinson, P. 1986. The spring emergence of Plecoptera (stoneflies) in the Willow Creek drainage, Humboldt Co., California, April–July 1984. M.S. Thesis, Humboldt State University, Arcata, California.

Received 22 February 1990; accepted 13 September 1990.